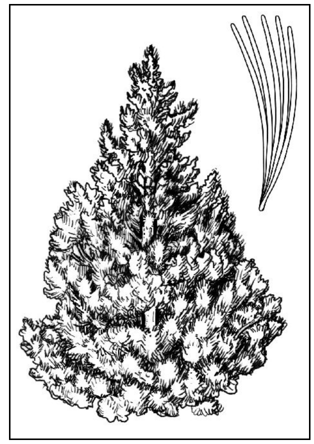
Upper Columbia Basin Network
Limber Pine Protocol Development Summary

(July 2008)



Protocol: Limber pine

Parks Where Protocol will be Implemented: CRMO and CIRO

Justification/Issues being addressed:
Limber pine, a subalpine five-needled pine similar to whitebark pine, is suffering extensive, heavy mortality throughout the foothills of the Rocky Mountains in the western United States and southern Canada. This severe die-off has been attributed to white pine blister rust, an invasive exotic fungal disease introduced to North America over a century ago. Blister rust infects the five-needled white pines causing cankers which often results in cessation of cone production and in some cases, death of the tree. Trees weakened by blister rust are also more susceptible to other problems such as mountain pine beetle and dwarf mistletoe infestations (Kendall et al. 1996).

North American five-needle pines have a low natural resistance to blister rust, which along with favorable climatic conditions, allows the disease to spread rapidly. Until recently, research tended to focus on blister rust infection of whitebark pine due to its high susceptibility and rate of decline in North America. But like its whitebark pine cousin, limber pine is also highly susceptible to blister rust. Surveys in northwestern Montana and southern Alberta found over one-third of the limber pine trees in those areas were dead and of the remaining trees, about 75% were infected with blister rust (Kendall et al. 1996).

Though it has traditionally received less research and attention, limber pine is vital to the forest communities in which it resides. It occupies and stabilizes dry habitats not likely to be occupied by other, less drought tolerant tree species, and is one of the first trees to colonize some areas after fire (Schoettle 2004). It often facilitates the establishment of high elevation late successional species and, having large, wingless, nutritionally-loaded seeds, is an important food source for several wildlife species, including Clark's nutcrackers and red squirrels. As with all of the white pines, loss of limber pine would result in an enormous ecosystem loss. Tomback et al. (2004) states that, "losses of these white pine ecosystems collectively represent significant reductions in forest biodiversity, especially considering geographic variation in habitat types, and the array of successional stages, understory plants, invertebrate and vertebrate species, and microbial and fungal communities that they harbor". Though blister rust will not likely cause the extinction of limber pine, over time it will impact the species' distribution, population dynamics, and functioning of ecosystems in which it is found (Schoettle 2004). Localized extirpations may also occur, particularly in areas peripheral to the species' core range, such as CRMO and CIRO.

Limber pine is the dominant tree species at CRMO, and while spatially limited, it accounts for much of the forested area within the monument. Small, isolated stands occur in the northern portion of the park and the monotypic stands tend to grow along the rocky exposed soils of north facing slopes of cinder cones and other volcanic features. Limber pine is more abundant on “aa” than “pahoehoe” flows, but in both cases is able to grow where water collects, and especially where the tree receives protection from fierce high desert winds. Kendall et al. (1996) reported finding no blister rust in the limber pine of CRMO. However in 2006, park natural resource managers found several infected trees within the park’s boundary (NPS, Paige Wolken, CRMO Botanist, pers. comm., 2006). At CIRO, limber pine occurs noticeably on Graham Peak and is scattered throughout other areas of the park. To date, blister rust has not been identified in CIRO.

Monitoring of blister rust infection in UCBN limber pine populations is important to understand landscape and stand level changes in the vegetation and fuels structure. Early detection and trend monitoring data will provide park managers with information needed to assess current outbreak status and develop an appropriate management response. It will also allow contribution to region-wide investigations into five-needle pine disease dynamics. Currently, the Whitebark Pine Ecosystem Foundation is serving as a key research and management communication vehicle and has supported development of monitoring protocols. The NPS Greater Yellowstone Network (GRYN) I&M program has developed a monitoring protocol based on the Foundation’s protocol, and we will adopt and adapt these as necessary. Common use of protocols will greatly facilitate information sharing across the northern Rocky Mountains and foothills region and provide managers with the best possible chance of combating blister rust infection.

Specific Monitoring Questions and Objectives to be Addressed by the Protocol:
Monitoring questions addressed by this protocol include:

- What is the extent of white pine blister rust infection in CRMO and CIRO and is the rate of infection increasing?
- What is the severity of existing infections of white pine blister rust on limber pine and is the severity increasing?
- What is the survival of mature limber pine trees infected with white pine blister rust and are mortality rates increasing?

Monitoring objectives addressed by this protocol include:

1) Conduct early detection status surveys for blister rust infection at CRMO and CIRO.
   Justification: *White pine blister rust has devastated limber pine in other areas of the Northwest (Kendall et al. 1996)) and has recently been discovered in CRMO (NPS, Paige Wolken, CRMO Botanist, pers. comm., 2006). Limber pine is an important floral species in these parks yet incomplete knowledge hinders our ability to conserve and manage it. Early detection can lead to better monitoring and possible containment or treatment of the disease.*

2) Estimate trends in the proportion, severity, and survivorship of limber pine trees infected with white pine blister rust in CRMO and CIRO.
   Justification: *Determining the proportion of trees infected and the severity of infection provides an understanding of the magnitude of the problem. Depending on the infection location, infected trees may survive for a considerable time. For example, trees infected on or near the trunk will have a higher risk of mortality and loss of reproduction than trees with upper canopy or branch infections. Estimating survival will enable us to*

distinguish occurrence and severity of white pine blister rust from the ecological effect of infestation (i.e., loss of limber pine). As a result, we will be better able to determine the vulnerability of limber pine in our parks.

Basic Approach:
There are existing protocols concerning whitebark pine and blister rust developed by GRYN and the Whitebark Pine Ecosystem Foundation (Tomback et al. 2004). The Whitebark Pine Ecosystem Foundation plans to produce another monitoring protocol specifically for limber pine for distribution in January 2007 and we will adopt and adapt this protocol as necessary. In the event this protocol is not completed, we will adapt the existing whitebark pine protocols for UCBN limber pine monitoring.

Surveys will be conducted from May through July, the best time for viewing the orange spore sacs, aecial blisters, produced by the active sporulating canker. These blisters may be visible to either the naked eye or with the aid of binoculars in the upper branches of the trees. Field crew will consist of two to three people with at least one person trained to recognize blister rust systems in limber pine and experienced in forestry sampling methods. Stands of mature (cone-bearing) trees will be prioritized for sampling and plots will be representative of the general area. The sampling unit will be a 50 m (164 ft) long by 30 m (98 ft) wide belt transect plot and selection of plots will chosen using either a simple random sample or a general stratified sample.

For each live tree, presence or absence of blister rust indicators will be recorded. We will consider the proportion of transects showing blister rust indicators as a surrogate for how widespread blister rust is within the parks. The proportion of trees infected and the number and location (branch or bole) of cankers will be interpreted as an index of severity of blister rust infections. The presence/absence of mountain pine beetle and dwarf mistletoe will also be noted.

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Development Schedule, Budget, and Expected Interim Products:
The NPS Greater Yellowstone Network Inventory and Monitoring program has developed a monitoring protocol for blister rust in whitebark pine (a very similar species) and we plan to adopt and adapt these methods for our protocol as necessary. The UCBN plans to submit a draft limber pine monitoring protocol for peer review in March 2009.

Literature Cited:
Kendall, K. C., D. Ayers, and D. Schirokauer. 1996. Limber pine status from Alberta to Wyoming. Nutcracker Notes 7:23-24. USDA Forest Service, Intermountain Research Station, IFSL. Missoula, MT.

Schoettle, A. W. 2004. Ecological roles of five-needle pines in Colorado: potential consequences of their loss. USDA Forest Service Proceedings RMRS-P-32.

Tomback, D. F., R. E. Keane, W. W. McCaughley, and C. Smith. 2004. Methods for surveying and monitoring whitebark pine for blister rust infection and damage. Missoula, MT: Whitebark Pine Ecosystem Foundation.